A NEW LEARNER'S SECURITY BEHAVIOR MODEL FOR M-LEARNING IN MALAYSIAN HIGHER EDUCATION INSTITUTION

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A thesis submitted
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DECLARATION

I declare that this thesis entitled "A New Learner's Security Behaviour Model for M-Learning in Malaysian Higher Education Institution" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……..

Name : ……..

Date : ……..……

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in term of scope and quality for the award of Doctor of Philosophy.

Signature	:	……..
Supervisor Name	:	……..
Date	:	……..……

DEDICATION

Dear God

I devoted my life and death to You, God. May my life is within your guidance.

Dear Parent

Thank you for your sacrifice and love. No such compensate except from God.

Dear Beloved Husband and Children

Thank you for your love, support, patience and encouragement that give me strength to finish this study. May God bless us, guide us and protect us to be good person.

Dear Teachers and Supervisors

Thank you for all the knowledge. May your knowledge are beneficial and useful for all humanity.

Dear Siblings

Thank you for your motivation and love.

Dear Friends

Thank you for all the knowledge, guide, encouragement and love. May our friendships blessed by God.

ABSTRACT

The motivation to conduct this research came from the awareness that the mobile device exposes m-Learning to security threats and vulnerabilities. The most unfocused issues were the mobile security behavior on learners itself; despite statistically determined that the risks are developing each day on mobile application and devices. Literature has pointed out that learners' security behavior required to be addressed to control the mobile security threats. This research proposes a learner's security behavioral model for mobile learning in Malaysia Higher Education Institutions (HEIs). With the security behavior reflection, this model aimed to improve the implementation and management of mobile security in m-Learning taking consideration of the learners' perspective. This research consisted of four phases, Planning phase, Data Collection Phase, Analysis Phase and Model Development Phase. Four mix-method studies were conducted to generate the dimensions for the model development. Review from the experts and risk based analysis approach confirmed the research findings and validated the practicality of addressing the learners' behaviors in mobile security. This research contributed to better understanding of the learners' complexity in mobile security. The research suggested that learners' security behavior view is significant in preparing mobile security model. This model found to be compatible and qualified, providing the m-Learning learners' perception within possible security threats that significantly controls to defend against malicious and non-malicious attacks. This approach can guide on what can be done to improve learners' participation and responsibilities on securing m-Learning. This research also extended the existing knowledge of mobile security and m-Learning fields by focusing analytically on the intersection of both fields. New knowledge about mobile security in the m-Learning from the learners' security behavior perspective was derived in this research.

ABSTRAK

Motivasi untuk menjalankan penyelidikan ini telah datang daripada kesedaran bahawa peranti mudah alih mendedahkan m-pembelajaran kepada ancaman keselamatan dan kelemahan. Isu yang paling tidak difokuskan adalah tingkah laku keselamatan peranti mudah alih pada pelajar itu sendiri, walaupun statistik menunjukkan bahawa risiko yang tinggi pada aplikasi mudah alih dan peranti. Kajian literasi telah menunjukkan bahawa tingkah laku pelajar yang perlu ditangani untuk mengawal ancaman keselamatan mudah alih. Penyelidikan ini mencadangkan model tingkah laku keselamatan peranti mudah alih pelajar untuk pembelajaran mudah alih di Institusi Pengajian Tinggi Malaysia(IPT). Dengan berlandaskan refleksi tingkah laku keselamatan, model ini bertujuan untuk menambah baik pelaksanaan dan pengurusan keselamatan mudah alih dalam m-pembelajaran yang mengambil kira perspektif pelajar. Penyelidikan ini terdiri daripada empat fasa iaitu fasa perancangan, fasa pengumpulan data, fasa analisis dan fasa pembangunan model.Empat kajian yang berasakan kaedah campuran kuantitatif dan kualitatif telah dijalankan untuk menjana dimensi untuk pembangunan model. Penyelidikan yang disyorkan menunjukkan bahawa pandangan tingkah laku keselamatan pelajar adalah penting dalam menyediakan model keselamatan mudah alih. Model ini didapati serasi dan layak memberikan persepsi m-pembelajaran pelajar dalam ancaman keselamatan yang mungkin terkawal untuk mempertahankan serangan berniat jahat atau sebaliknya. Pendekatan ini boleh menjurus kepada apa yang boleh dilakukan untuk meningkatkan penyertaan dan tanggungjawab pelajar ke arah m-pembelajaran. Kajian ini juga memperluaskan pengetahuan sedia ada dalam bidang keselamatan dan m-pembelajaran mudah alih dengan memberi tumpuan secara analisis di dalam kedua-dua bidang. Pengetahuan baharu tentang keselamatan mudah alih dalam m-pembelajaran daripada perspektif tingkah laku keselamatan pelajar telah diperolehi melalui kajian ini.

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LIST OF ABBREVIATIONS/SYMBOLS

BYOD	Bring Your Own Device
CAPs	Critical Agenda Projects
CIA	Confidentiality , Integrity, Availability
CPA	Critical Agenda Projects
E-Learning	Electronic Learning
FMEA	Failure Mode and Effect Analysis
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HD2	High Definition 2
HEI	Higher Education Institution
HSPA	High Speed Packet Access
ICT	Information Communication and Technology
IEEE	Institute of Electrical and Electronics Engineers
IFIP WG	International Federation For Information Processing Working Group
IMT-2000	Is the term used by the International Telecommunications Union (ITU) for a set of globally harmonized standards for third generation (3G) mobile telecoms services and equipment
iOS	an operating system used for mobile devices manufactured by Apple Inc.
IT	Information Technology
ITU	International Telecommunication Union
ISM	Information Security Management
KRA	Key Result Area

LTE	Long-Term Evolution
MAFTIA	Malicious and Accidental Fault Tolerance for Internet Applications
MIS	Management Information System
M-Learner	Mobile Learners
M-Learning	Mobile Learning
MMS	Multimedia Messaging Service
MOBILES	Mobile Learners Security Model
MOE	Ministry Of Education
MOHE	Ministry of Higher Education
MyCert	Malaysia Computer Emergency Response Team
NMT	Nordic Mobile Telephony
PC	Personal Computer
PDA	Personal Device Assistance
RPN	Risk Priority Number
SMS	Short Messaging Service
TAM	Technology Acceptance Model
UMTS	Universal Mobile Telecommunications System
UNESCO	United Nations Educational, Scientific and Cultural Organization
VM	Virtual Machine
WAP	Wireless Application Protocol
WiMAX	Worldwide Interoperability for Microwave Access

LIST OF PUBLICATIONS

CONFERENCE PUBLICATION

1. Presented Research Paper of Title: "Mobile Learning: Towards Secure Learning Environment" Sheila M, Faizal M. A., Shahrin S , in the 12th International Conference on Information (ICI 12)12th to 13th Dec 2012.Abstract and Full Paper is published in the Conference Proceedings.

2. Presented research paper title: Learner Centric in M-Learning: Integration of Security, Dependability and Trust(Short Paper) and Learners' Ensemble Based Security Conceptual Model For M-Learning System in Malaysian Higher Learning Institution (Reflection Paper), Sheila M *1, Faizal M. A.*2, Shahrin S at 10th International Conference on Mobile Learning 2014 , Madrid , Spain 28 February -2 March 2014 . Both papers are published in Proceeding of the 10th International Conference on Mobile Learning IADIS ML2014 Book (ISBN: 978-989-8704-02-3).

3. Presented research paper title: The Implementation of Mixed Method in Developing a Mobile Learners Security Framework at International Conference on Computational Science and Technology, Sheila M,Faizal M. A.,Shahrin S, 2014(ICCST'14) organized by University Malaysia Sabah with IEEE organization,27-28 August 2014,Kota Kinabalu,Sabah.DOI:10.1109/ICCTST.2014.7045177.*http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=7031546*

4. Presented paper title: "BYOD: Managing Mobile Learning Security in Malaysia Higher Learning Institutions", Sheila M, Faizal M. A., Shahrin S, for presentation in 1st international Conference on Educational Studies (ICES-2015), at Pulai Spring Resort, Johor Bahru, Malaysia to be held on June 3-4, 2015.

5. Presented Paper Title: "A Conceptual Framework for Leaner's Security Behavior in M-Learning Environment". International Conference on Teaching and Learning (ICTL 2016) on 5-6 October, 2016 in Kuala Lumpur.

JOURNAL PUBLICATION

1. Published Article on The Malaysian Journal of Education Technology (MJET) impact factor 0.7490 9 (2012) Global Institute for Scientific Information (GISI). Volume 12, Number 3, September 2012 pp. 33-41.Title: Designing Ensemble Based Security Framework for Secure M-Learning System in Malaysia Higher Learning Institution.

2. Published Article in European Journal of Scientific Research (ISSN 1450-216X/1450-202X).Vol. 114 No 2, November, 2013, pp.408-422.
   Title: Systematic Review on Mobile Learning Research Initiatives and Implementation. http://www.europeanjournalofscientificresearch.com. Journal is indexed in Scopus Database with impact factor 0.713.

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4. Published article in International Journal of Mobile Learning and Organization (IJMLO) Inderscience Publishers, Geneva, Switzerland, accessible through the ACM digital library and *indexed* in Scopus. Title: Dimension of Mobile Security Model: Mobile User Security Threats and Awareness, Sheila M, Faizal M. A., Shahrin S. Int. J. Of Mobile Learning and Organization, 2015vol.9, No.1, Pp.66–85. ISSN: 1746-725x, EISSN: 1746-7268,DOI: 10.1504/IJMLO.2015.069718

5. Sheila M., Faizal M. A. and Shahrin S. "Managing Mobile Learning Security in Malaysia Higher Learning Institutions." In Man in India, Serials Publications Quarterly, ISSN: 0025-1569, No.96 (2016), No.1 (2016), pp. 19-37. http://serialsjournals.com/articles.php?volumesno_id=917&journals_id=40&volumes_id=836

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The specific components discussed in this chapter include background of the research, the research problem, the research questions, the research objectives and the conceptual framework that guide this research.

1.2 Background of Research

Today, wireless and the mobile application has become a very famous technology among the 21st century generation. According to Gartner's report Gartner (2011) there is a massive increase in mobile device technology penetration. As stated by Magdirila (2013) in Nielson Report, Malaysia is ranked as the 3rd in Asia region for mobile device adoption. Hence, On Device Research (2014) reported Malaysia has the youngest users which the age ranked between 20 to 49.The transformation of mobile technologies continues to develop with the entrance of smaller, more complicated and powerful devices which are capable of transferring data in a variety of formats anywhere, at any time. Certainly, the openings for changes in this area are diverse and continually supporting the focus of all the stakeholders associated from higher learning institutions.

Without a doubt, Malaysia is characterized as having established market for mobile technology, demonstrating high market penetration of mobile phones that enables Mobile